PLASTIC FILM PACKAGING WITH TEARABLE TAPE STRIP

Cross-Reference to Related Applications

This application is a continuation-in-part of U.S. Patent Application Serial No. 09/315,249, entitled "Tear Control Tape and Container with Tear Control Closing Tape" filed May 20, 1999, which is a continuation-in-part of U.S. Patent Application Serial No. 09/086,317, entitled "Tear Control Tape for Closing Containers" filed May 28, 1998, now abandoned.

Technical Field

The present invention relates to plastic film packaging and tearable tape strips. More particularly, the present invention relates to packaging formed with a continuous, tear-resistant film having a tearable tape strip that facilitates opening thereof.

Background of the Invention

Containers or packaging, such as bags and other packages, must be securely closed to contain their contents. The packaging must remain closed during storage and shipping, and must withstand vibrations and shocks of rough handling. When distribution is complete, the consumer or end-user needs to open the package to remove the contents. Ideally, the package can be opened without tools or special skills. Achieving both secure closure and easy opening is difficult. Many packages can be secure for shipment, but are often times difficult to open. For example, multiple wall paper bags of dog food or fertilizer often have sewn tops which remain closed during shipping, but are difficult for the end-user to open without tools or without damaging the bag and spilling unused contents. Alternatively, plastic films can be used as the packaging material, for example to contain water softener pellets. Again, however, especially where a tear-resistant film is employed, these packages are difficult for the end-user to open.

With respect to corrugated or paperboard packaging, a conventional, narrow-width tear strip can be used to facilitate opening thereof. In this regard, the Minnesota Mining and Manufacturing Company (3M) has sold conventional tear strips for many years. One version of a conventional, narrow-width tear strip (3M #8612 Tape) has a polyethylene terephthlate (PET) backing and a reinforcing filament of polyester yarn or fiberglass coated with a pressure sensitive adhesive (PSA). This tear strip is applied to the inside of a corrugated box or to the inside of a paperboard mailing envelope. The corrugated board or paperboard is nicked on the outside of tear strip to provide a tab which the end-user can pull. During opening, the tear strip remains in tact and is not split. The tear strip pulls and tears through the corrugated board or paperboard. This conventional, narrow-width tear strip can only be used in lightweight situations because the force required to tear the material is relatively low. Other versions use a tensilized polypropylene tape with a pressure sensitive adhesive and, optionally, a reinforced strapping tape. These types of tearable tape strips can also be applied to the adhesive side of a wider film tape such as a box sealing tape or a heat shrinkable tape. Again, the wide tape is nicked to provide a tab and to initiate tearing. The distance between the nicks is wider than the tape strip. This is only used for lightweight packages because the nicks tend to propagate prematurely during shipping, if used on a heavier shipping container. Using this kind of conventional, narrow-width tear strip on a linear low-density polyethylene (LLDPE) tape backing would not function because the tear strength and the elongation of the LLDPE are too high.

Efforts have been made to improve upon these paper-based envelopes, as well as to render them more easily openable with the above-described, conventional, narrow-width tear strips. For example, U.S. Patent No. 4,781,296 discloses making a Tyvek® spun-bonded olefin envelope openable. It improves upon the common paperboard envelopes which are relatively easy to open using conventional narrow-width tear strip products. This highly tear-resistant envelope material can be fused by ultrasonic sealing, creating lines of weakness. European Patent No. 447209 discloses an improved opening for Tyvek® envelopes. It uses reinforced strapping tape (or similar tape) which is nicked on

the ends to control the direction of the tear through the envelope. It also includes cutting through the Tyvek® material, rather than just weakening it. These patents describe opening devices for lightweight mailing envelopes; they function well in this lightweight application, but are not readily useable to resist splitting when used on a heavier package because the tape is relatively easy to tear.

European Patent No. 755868 discloses a paperboard envelope using a single tape to close and open the envelope. A uniaxially-oriented plastic film is adhesive-coated on both sides, allowing it to function as a closing tape, as well as an opening tape. The tape is nicked to control the direction of tear. In addition to providing packaging strength, the paperboard material provides requisite tear resistance.

The above applications of conventional, narrow-width tear strips to paperboard or Tyvek® envelopes are quite viable. Unfortunately, however, the same techniques are not readily adaptable to plastic film-type packaging. Plastic-based film packaging material has become increasingly popular. Plastic films are relatively inexpensive, and highly amenable to packaging on a mass production basis. Even further, plastic films can be tightly wrapped about the article in question, such as with a shrink wrap or skin packaging technique. As with paperboard or Tyvek® packaging, plastic film packaging presents certain concerns relating to opening by the end-user, especially where a tear-resistant film (i.e., exhibiting a puncture-propagation tear resistance in excess of 20 Newtons (N) per ply) is used. Typically, the end-user is forced to use a cutting tool to open the film packaging. This can undesirably lead to injury and/or product damage.

Alternatively, conventional, narrow-width tear strips (with a PSA or with a heat-activated adhesive) have been employed with lightweight low tear strength packaging films. One example of such an application is with a biaxially oriented polypropylene (BOPP) film overwrap applied about a pack of cigarettes. With low tear strength-type films (and/or plastic films that exhibit little, if any, stretching with tearing), conventional, narrow-width tear strips are workable opening devices. However, many plastic films useful for product

packaging are tough and tear-resistant. For example, polyethylene film is widely used to package or contain a variety of products, such as beverage containers, food, etc. Unfortunately, due to the tear strength associated with a tear-resistant film such as polyethylene, conventional, narrow-width strips are essentially useless. A conventional tear strip cannot tear a "clean" opening through the tear-resistant film. Instead, the tear-resistant film will resist the tearing force, likely stretching or elongating at the point the tear force is applied. Either the film will simply not tear and the tear strip releases from the film, or the film will continually stretch so that the resulting opening, if any, is insufficient to access the contained article. While it may be possible to weaken the film in the area of the convention, narrow-width tear strip (e.g., imparting perforations) to promote tearing as is done with Tyvek® envelopes, these imperfections often times lead to premature failure of the packaging material prior to delivery to the end-user.

Plastic films continue to be highly popular packaging materials. However, where the plastic film is tear-resistant and not otherwise cleanly tearable, conventional, narrow-width tear strips cannot be used to satisfactorily open the package. Instead, when presented with a tear-resistant film packaging, an end-user is typically required to use a cutting tool to open the package, possibly leading to injury and product damage. Therefore, a need exists for packaging utilizing a tear-resistant film in combination with an applicable tearable tape strip for tearing an opening in the film.

Summary of the Invention

One aspect of the present invention relates to packaging for containing an article. The packaging includes a continuous, tear-resistant film and a tearable tape strip. The film is formable to define an enclosed region for containing an article. The tearable tape strip is secured to the film. In this regard, the tearable tape strip is configured to controllably tear an opening through the film for accessing the enclosed region upon tearing of the tearable tape strip. By providing a continuous, tear-resistant film, the packaging is available to safely contain a wide variety of different articles, while withstanding the rigors of most shipping and handling environments. Further, the tearable tape strip allows an

end-user to easily open the packaging. In one preferred embodiment, a single tearable tape strip is provided and is formed as an internally tearable, reinforced strapping tape adhered to an inner surface of the film.

Another aspect of the present invention relates to a packaged good article including an article and a package. The package includes a continuous, tear-resistant film and a tearable tape strip. The film forms an enclosed region within which the article is contained. Further, the tearable tape strip is secured to a surface of the film. In this regard, the tearable tape strip is configured to controllably tear an opening through the film for accessing the article upon tearing of the tearable tape strip. In a preferred embodiment, the tear-resistant film is wrapped about the article, and the article can assume a wide variety of forms such as a food product, a plurality of products, etc.

Yet another aspect of the present invention relates to a method of a packaging article. The method includes providing an article, and providing a continuous, tear-resistant film. A tearable tape strip is secured to a surface of the film. The film is then formed to define an enclosed region containing the article. Upon final assembly, the tearable tape strip is configured to controllably tear an opening through the film for accessing the article upon tearing of the tearable tape strip. In one preferred embodiment, the method of the present invention requires securing only a single tearable tape strip. Further, the film is preferably wrapped about the article, as opposed to sliding the article within a pre-formed envelope. Thus, because the film can be formed as something other than an envelope, the article need not be relatively flat, but instead can have an irregular shape, such as commonly found with food products, groupings of beverage containers, etc.

Yet another aspect of the present invention relates to a method of opening a packaged good article. The method includes providing a packaged good article including an article contained within an enclosed region formed by a continuous, tear-resistant film having a tearable tape strip secured to a surface thereof. The tearable tape strip is then torn to controllably tear an opening through the film. Unlike some previous opening methodologies associated with tear-resistant film packaging, a separate cutting tool is not required.

Brief Description of the Drawings

Figure 1 is a cross-sectional view of a tape of the present invention.

Figure 2 is a perspective view of the tape of Figure 1 applied to a container.

Figure 3 is a partial perspective view of another embodiment of the tape applied to a container.

Figure 4 is a cross-sectional view of a tape according to another embodiment of the present invention.

Figure 5 is a cross-sectional view of a tape according to another embodiment of the present invention.

Figure 6 is a cross-sectional view of a container according to another embodiment of the present invention.

Figure 7 is a perspective view of the container of Figure 6.

Figure 8A is a perspective view of a packaged good article according to another embodiment of the present invention in a closed state.

Figure 8B is a perspective view of the packaged good article of Figure 8A in an opened state.

Figure 9A is an enlarged, cross-sectional view of a portion of the packaged good article of Figure 8A.

Figure 9B is an enlarged, cross-sectional view of a portion of an alternative packaged good article.

Figure 10 is a perspective view of an alternative packaged good article according to another embodiment of the present invention.

Figure 11 is a perspective view of an alternative packaged good article according to another embodiment of the present invention.

Figure 12 is a perspective view of an alternative packaged good article according to another embodiment of the present invention.

Figure 13 is a perspective view of an alternative packaged good article according to another embodiment of the present invention.

Description of the Preferred Embodiments

One aspect of this invention is a tape which functions both to close a container 9 and also to provide a mechanism to easily open the container. Although the container 9 can be any container such as envelopes and boxes, one aspect of the invention works particularly well on flexible containers such as bags like multiple wall paper bags for storing granular material. As shown in Figure 1, the tear strip tape 10 combines a base layer 12 which is a tear-resistant tape, with a tearable tape strip 14. The base layer 12 includes a tear-resistant backing 16 having a first side 18 and a second side 20, and an adhesive 22 which in the illustrated embodiments is located on the first side 18 of the backing 16. The adhesive 22 can be applied to the backing 16 by any known method such as knife coating.

The tearable tape strip 14 can be attached to either the first side 18 or the second side 20 of the backing of the base layer. In several of the illustrated embodiments, the tearable tape strip 14 is adhered to the first side 18 of the backing 16 using the adhesive 22. In use, the tearable tape strip 14 is located on the container 9 between the container and the base layer 12, without adhering to the container. In several of the illustrated embodiments, the tearable tape strip 14 includes a base layer 24 and its own adhesive 26 on one side of the base layer to assist adherence to the base layer 12 of the tear strip tape 10. In another embodiment, the adhesive 26 is on the other side of the tearable tape strip base layer 24 to adhere to the container 9. In another embodiment, the tearable tape strip 14 need not include an adhesive.

The backing 16 can be a linear low-density polyethylene (LLDPE), low-density polyethylene (LDPE), cast polypropylene, Kraton/polypropylene blends, or other tear resistant film. The tearable tape strip 14 can be tearable filament reinforced tape or a reinforced strapping tape (RST) having filaments or ribs 28. Suitable RSTs are described in U.S. Patent Nos. 5,079,066 and 5,080,957. The tearable tape strip 14 could also be tensilized polypropylene or other oriented or non-oriented films which tear preferentially in the longitudinal direction. The ribs 28 constrain the tears in the tearable tape strip 14 to control the direction of

tear. Nicks 30 in the tearable tape strip 14 form an end tab 32 and initiate points of tear. Stress from handling the container 9 is concentrated at these points. The tear resistant base layer 12 prevents the tear from propagating prematurely, yet allows a person to pull the end tab 32 to easily open the container 9. A wide variety of tear-resistant tapes 12 are available. By balancing the strength, premature splitting, and ease of opening, a tape 10 with the desired overall characteristics can be achieved. Containers 9 have been closed with this invention and have been subjected to severe rough handling tests. They have successfully withstood these stresses yet have allowed easy opening. This tape 10 uses a weakness of the tearable tape strip 14, such as RST, (its tendency to split in the longitudinal or machine direction) coupled with an inability to tear cleanly through the tear resistant backing to form a very functional opening feature for containers. "Tear cleanly" means to tear open consistently, with a relatively uniform tearing force, without excessive distortion of the torn film (i.e., there are not extended stretched-out or jagged edges).

One embodiment of this invention is shown in Figure 2. A backing 16 made of tear resistant film such as LLDPE and an adhesive 22 such as PSA functions as the base layer 12 which closes the container 9. A narrower filament reinforced tape or reinforced strapping tape is the tearable tape strip 14 and is laminated to the tear resistant base layer 12, adhesive to adhesive. Nicks 30 through the tape 10 initiate points of tear. The nicks 30 are located through both the base layer 12 and the tearable tape strip 14 of the tape 10. The tape 10 is applied to the container 9. The end tabs 32 formed at the end of the tape assist opening the container 9.

In an alternative embodiment, shown in Figure 3, the end tabs 32 can lay flat against the container 9 during shipping and distribution. In this version, the nicks 30 start from the end of the tape 10 at a location such that they pass through only the base layer 12. The distance between the nicks 30 is greater than the width of the end tab 32. As shown, the nicks are then directed to pass through part of the tearable tape strip 14 as well as the base layer. This direction change is shown as a smooth curve, but any shape can be used. The key to this feature is that at the end of the tape, the end tab 32 includes part of the tape 10

with adhesive 22 to allow adhesive of the closure tape to hold lightly onto the bag, while the end tab 32 has at least a portion that extends through the tearable tape strip 14.

In another embodiment shown in Figure 4, tape 40 includes a tape layer 42 that is a strip of film tape, such as a box sealing tape made of biaxially oriented polypropylene. The tape layer 42 includes a backing 44 and an adhesive 46. This tape layer 42 is not tear-resistant when nicked but provides good closure strength at a low cost. The narrower tearable tape strip 14 is laminated to a tear resistant tape 12 of a similar width, such as a 3M #8883 tape. The tearable tape strip 14 includes a base layer 24 and an adhesive 26 and the tear-resistant tape 12 includes a base layer 16' and an adhesive 22' although the adhesive is not required. The tear resistant tape 12 is located only in the area where its function is required, the area straddling the two portions of the container 9 that are adhered to each other to close the container. (Note that if a box sealing tape was used with RST without a tear resistant film, nicks in the RST would propagate too easily.) This embodiment, like that of Figure 1, prevents a tear from propagating prematurely, yet allows a person to pull the end tab 32 to easily open the container 9.

This structure could be formed in several ways. One way is that the tear-resistant tape 12, such as #8883 tape, made by 3M, St. Paul, Minnesota, could be laminated between the box sealing tape layer 42 and the tearable tape strip 14 at the point of application. In another method, an RST tape could be used as the tearable tape strip 14 and could be laminated to tear-resistant tape 12 (3M #8883 tape) and provided to a customer in roll form. This would be applied to the box sealing tape layer 42 at the point of application. Yet another method involves putting all of the layers together during manufacturing. A tear resistant tape 12 is coated or laminated to a tearable tape strip 14. This multiple layer configuration is then attached to a tape layer 42 which includes a backing 44 and an adhesive 46. Figure 5 shows an embodiment where there is no adhesive on the tear resistant layer. The tear resistant base layer 16 only is located between the tape layer 42 and the tearable tape strip 14 to form tape 50.

In one example, a 20 kg (44 lb) bag of dog food was closed with a 40.6 cm (16 in) long strip of 48 mm wide tear resistant adhesive base layer 12, such as 3M #8883 tape, having a 0.008 cm (3 mil) LLDPE backing 16 and a PSA adhesive 22. (The 3M #8883 tape is a "stretchable tape" which is used here for its tear resistant properties.) A 12 mm wide strip of tearable tape strip 14 (3M #864 RST tape) was applied and nicks 30 were formed in the ends to create end tabs 32. This bag was subjected to drop tests according to ASTM D5276 standards. Drops of 76 cm (30 in) were made on the front, back, two sides, and two ends of the bag. The bag completed the six drops without opening. The bags were then lifted up several times by its "ears," the notches formed by the gussets, without opening and without the nicks propagating. The bag was easily opened by pulling the tab.

A similar bag of dog food was closed with the tape having 48 mm wide box sealing tape (3M #372 tape) laminated to 12 mm wide 3M #8883 tape and 12 mm wide 3M #864 tape. Some bags were also closed with a structure of 48 mm wide box sealing tape and a 12 mm wide lamination of 3M #864 tape and a 0.008 cm (3 mil) LLDPE film, and other bags were closed with a 0.010 cm (4 mil) LDPE film. This structure also completed the drop tests and lifting tests well, followed by being easily opened.

To measure the forces required to open the tape or base structures, tests were conducted on a ZPE 1000 High Rate Peel Test System, by Instrumentors, Inc. Tests were conducted at 0.5 m/s (which is representative of the actual speed used by end-users) and the force required to pull a tab (with two tears through the tape) was measured by Newtons. The following tables summarizes the results. Tests at other speeds were also conducted. The results at these speeds were predictable; lower speeds yielded increased forces and higher speeds yielded decreased forces. At all speeds, there were similar force differences among the various tape samples.

Example No.	Base Layer	Tearable Tape Strip	Force (N)
Comparative # 1	#864 RST	#864 RST	2.5
Comparative # 2	#372 Box Sealing Tape	#864 RST	1.8
Comparative # 3	#372 Box Sealing Tape	#8612 (nicks along sides)	0.2
1	#8883 Stretchable Tape	#864 RST	12.8
2*	#8883 Stretchable Tape	#864 RST	9.1
3*	4 mil LDPE	#864 RST	5.1

* Includes #372 Box Sealing Tape overlying the Base Layer

Table 1

Table 1 illustrates that using a tear resistant film (3M #8883 tape in the examples) in the structure significantly increases the force required to tear and thus decreases the chance of premature opening of the container. If a standard tear strip tape such as 3M #8612 (with nicks along the sides) is used with #8883, the LLDPE backing deforms and elongates but it does not provide a functional tear. However, an example using a single tape construction of #8883 Stretchable Tape did not work. The tape broke without tearing along its length.

In another embodiment, shown in Figures 6 and 7, a container 60 includes a tape for sealing the container. The container 60 can be flexible and can be a bag. The tape can be a tearable tape strip 62 and can be part of the container 60 in a way to simplify the tape. For example, the container 60 can have a flap 64 for closing the container. The flap 64 has first and second major surfaces and is formed of a tear resistant film. Film is defined as being continuous and made from material other than sheetstock. (Sheetstock is defined as material that is made of fibers. The fibers can be felted, matted, beaten, or refined, and can be made of cellulose, as with traditional paper, or of other materials, including synthetic and plastic materials that can be bonded together.)

The flap 64 can be weakened (such as by slits, perforations, or score lines) along subsequent tear lines. As shown, the flap 64 is unweakened. Unweakened means that there are not slits, perforations, or score lines in the flap, and the flap is untreated in any way intended to weaken it. The tearable

tape strip 62 and the flap 64 can have nicks 70 at their ends to facilitate beginning the opening process. These nicks 70 can form a tab and do not weaken the flap 64 because the flap is made of a tear-resistant plastic. The flap 64 need not be weakened because the tearable tape strip 62 makes the otherwise tear-resistant film relatively easy to tear to open the container. This is a significant difference from the known sheetstock envelopes and containers which require weakening in order to function well. Weakening involves extra manufacturing steps and increased costs.

The container 60 includes a mechanism, such as glue or adhesive 66, that adheres the first major surface of the flap to the container to close the container. The adhesive 66 can be coated on at least part of the first major side of the flap 64, or on the other part of the container 60, or on both. The adhesive 66 can optionally be protected by a release liner before the container 60 is closed. The tearable tape strip 62 is located on either or both of the first and second major surfaces of the flap 64. The tearable tape strip 62 permits tearing of itself and the flap 64 with a given force notwithstanding that the tear resistant film flap 64 is otherwise not cleanly tearable.

If the tearable tape strip 62 is located on the first major surface of the flap 64, tearing the tearable tape strip tears through the flap. In this version, an optional cover tape 68 can be located on the second major surface of the flap 64, opposite the tearable tape strip, as shown in Figure 6. The cover tape 68 improves the ability to tear cleanly through the flap 64, perhaps by constraining the elongation of the flap during tearing. This is shown by the decreased force required for Example 2, which uses a box sealing tape, as compared with Example 1, which does not. Various tapes can be used as a cover tape 68 including #371 Biaxially Oriented Polypropylene (BOPP) Box Sealing Tape, #355 PET Box Sealing Tape, #821 Acetate Tape, and #600 Polyvinyl Chloride (PVC) Tape, all made by 3M, St. Paul, Minnesota. These tapes all have lower elongation than the film used for the flap 64.

The flap 64 can be made of LLDPE, LDPE, cast polypropylene, and blends of Kraton and polypropylene. The tearable tape strip 62 can be RST, tensilized polypropylene, and filament reinforced tape. Also, the tearable tape

strip 62 can include filaments, ribs, or both, formed on either or both of its first and second sides.

An alternative embodiment of the present invention relates to tear-resistant film packaging having an easy-open feature. For example, Figures 8A and 8B illustrate a packaged good article 100 in accordance with the present invention in both a closed state (Figure 8A) and an opened state (Figure 8B). The packaged good article 100 includes packaging 102 and an article 104. As described in greater detail below, the article 104 can include a plurality of objects (as with the embodiment of Figures 8A and 8B), or a single object. In general terms, the packaging 102 forms an enclosed region 106 within which the article 104 is contained.

The packaging 102 includes a continuous, tear-resistant film 108 and a tearable tape strip 110. The tear-resistant film 108 forms the enclosed region 106 and contains the article 104. The tearable tape strip 110 is secured to a surface of the film 108 and facilitates opening of the film 108 via tearing of the tearable tape strip 110.

The continuous, tear-resistant film 108 can assume a wide variety of forms, and is a plastic material. More particularly, the film 108 is highly durable, satisfying the constraints associated with most shipping and handling environments. As described below, the film 108 is characterized as being "continuous" and "tear-resistant". In a preferred embodiment, the film 108 is further characterized as being "tough".

First, by being "continuous", the film 108 is made from material other than sheetstock. Sheetstock is defined as material that is made of fibers. The fibers can be felted, matted, beaten, or refined, and can be made of cellulose, as with traditional paper, or of other materials, including synthetic and plastic materials that can be bonded together, as with Tyvek®.

Second, the film 108 is characterized as being "tear-resistant" by exhibiting a relatively high puncture-propagation tear resistance. In this regard, films having a puncture-propagation tear resistance equal to or greater than 20 N/ply; more preferably 30 N/ply; most preferably 40 N/ ply are considered to be "tear-resistant". As described in greater detail below, the puncture-propagation

tear resistance of a film is preferably determined in accordance with ASTM D2582-93, a standard test method for determining puncture-propagation tear resistance of plastic film and thin sheeting.

Finally, the film 108 is preferably characterized as being "tough". "Toughness" is with reference to the energy required to tear the film 108 a certain distance, and thus is related to tear strength. Further, however, a "tough" film has an elongation attribute whereby an imparted tear will not readily propagate along the film. In other words, a "tough" film stretches before tearing in response to a tearing force. Thus, in a preferred embodiment, the film 108 will not, in and of itself, cleanly tear, where "cleanly tear" means to tear open consistently, with a relatively uniform tearing force, without excessive distortion of the torn film. (There are no extended, stretched-out or jagged edges).

With the above-described characteristics of the film 108 in mind, a number of plastic films are acceptable. Examples of available continuous, tear-resistant films include polyethylene, linear low-density polyethylene (LLDPE), low-density polyethylene (LDPE), Surlyn® ionomer film (available from DuPont), Kraton/polypropylene blends, copolymers of propylene and ethylene, blends of polypropylene and polyethylene, nylon, polyvinyl chloride, and polyvinylidene chloride to name but a few. It will be understood that each of the above-listed films (as well as other materials not specifically designated) must have a certain thickness and certain processing to qualify as "tear-resistant" as defined herein. In other words, "tear-resistant" is a function of the material type, the material thickness, and material processing. For most packaging applications, however, each of the above-identified materials are currently provided with a thickness sufficient to qualify as "tear-resistant". Further, the film 108 can have either a single layer or multi-player construction. With a multiple layer film, the layers can be identical or different. For example, in one preferred embodiment, the film 108 includes a first layer of polyethylene and a second layer of polypropylene. By way of example, materials specifically excluded from use as the film 108 include Tyvek®, cellophane, cellulose acetate, BOPP, etc.

The tearable tape strip 110 is similar to that previously described, and is configured to controllably tear an opening through the film 108 upon tearing of the tearable tape strip 110. The phrase "controllably tear" is in reference to a substantially uniform or clean tear through the film 108, with the tear in the film 108 corresponding in length and width with the tear in the tearable tape strip 110. The edges of the tear in the film 108 are not relatively jagged or otherwise relatively stretched. In this regard, due to the tear-resistant attribute of the film 108, the tearable tape strip 110 is preferably formed to be internally tearable. More particularly, and with additional reference to Figure 9A, the tearable tape strip 110 is preferably an elongated body defined by a longitudinal central section 120 and opposing, longitudinal sides 122. The central section 120 is tearable relative to the opposing sides 122, such as by forming the tearable tape strip 110 to include a plurality of ribs 124 extending from a base 126. With this configuration, then, a pulling force applied to the central section 120, such as at a pre-formed tab 128 (shown most clearly in Figure 8A), causes the central section 120 to cleanly or uniformly tear from the opposing sides 122 between respective ones of the ribs 124. Thus, because the central section 120 tears relative to the sides 122, the tearable tape strip 110 is "internally tearable". Notably, a size of the tab 128 defines a width of the central section 120, such that a width of the central section 120 and each of the sides 122 can be varied for a particular application. With this preferred configuration, the opposing sides 122 effectively support or reinforce materials secured to the tearable tape strip 110 (such as the film 108), thereby allowing the central section 120 to perform a controlled tear through the contacted material. Alternatively, the tearable tape strip 110 can have something other than an internally tearable configuration, such as a two-section, side-by-side tearing design.

As previously described, the tearable tape strip 110 can assume a variety of forms, including a reinforced strapping tape, tearable filament reinforced tape, tensilized polypropylene, or other oriented or non-oriented films which tear preferentially in the longitudinal direction. In a most preferred embodiment, the tearable tape strip 110 is a reinforced strapping tape having a width of at least 8 mm, available, for example, under the tradename 864 Scotch® Reinforced

Strapping Tape from 3M. Unlike conventional tear strips that are not internally tearable and have widths less than 8 mm, the tearable tape strip 110 can effectuate a controlled tear through the continuous, tear-resistant film 108.

Several exemplary films were tested to identify usefulness of the tearable tape strip 108 as compared to a conventional, narrow-width tear strip. In particular, each of the films listed in Table 2 below was subjected to a puncture-propagation tear resistance test in accordance with ASTM D2582-93 using a carriage weight of 1195 grams and a carriage height of 17.3 cm. Further, the films were also tested by hand tearing to evaluate the ability of a conventional, narrow-width tear strip to tear through the film. The conventional, narrow-width tear strip was a tear strip available from 3M Company under the trade designation "3M 8621 Tear Strip Tape", having a width of 0.125 inch (3.2 mm).

In some cases, the samples were obtained as commercially available envelopes including a flap. In other cases, the samples were not pre-formed into envelopes, but instead were commercially-available as films. Regardless, the conventional, narrow-width tear strip was affixed to each of the listed film or envelopes samples, and attempted tearing carried out through the respective film or envelope flap at a speed of approximately 0.3 meters/second. Tearing tests were performed in both the machine direction ("MD") and in the crossweb direction ("CD") for each sample. With respect to the envelope samples, the machine and crossweb directions were unknown. Thus, for the envelope samples, "MD" is in reference to an attempted tear along a length or "long side" of the envelope flap, whereas "CD" is in reference to an attempted tear perpendicular to a length of the envelope flap. Finally, the tearability of each sample was rated according to the following criteria: a sample was assigned a "1" where the sample tore easily and cleanly; a sample was assigned a "2" where the sample tore but not cleanly; and a sample was assigned a "3" where the sample did not tear. With the above explanations in mind, the following results were obtained:

Film	Sample Type	Tear Direction	Approximate Film gauge (microns)	Narrow-width Tear Strip Tear Rating	Puncture-Propagation Tear Resistance (N/Ply) (ASTM D2582-93)
PET	Film	MD	38	1	7.6
SAC Select®	Envelope	MD	102	2	22.1
SAC Select®	Envelope	CD	102	3	62.8
SAC ShurTuff®	Envelope	MD	71	3	69.5
SAC ShurTuff™	Envelope	CD	71	3	69.1
Tyco 8754	Film	MD	51	3	51.0
Tyco 8754	Film	CD	51	3	51.6
Tyco 2304-B	Film	MD	76	3	58.4
Tyco 2304-B	Film	CD	76	3	60.2
Tyco 3904	Film	CD	38	3	50.7
Tyco 3904	Film	MD	38	2	42.7
Tyco 2215-G	Film	CD	51	3	51.0
Tyco 2215-G	Film	MD	51	2	41.1

Table 2

As a point of reference, the samples designated as "SAC" are available from Sealed Air Corporation of East Saddle Brook, New Jersey, and the samples designated as "Tyco" are low-density polyethylene film available from Tyco International Inc. of Exeter, New Hampshire.

Based upon the above test results, a conventional, narrow-width tear strip is unable to controllably tear an opening through a tear-resistant film exhibiting a puncture-propagation tear resistance greater than 20 N/ply. In contrast, the tearable tape strip 110 associated with the present invention was surprisingly found to controllably tear each of the above-listed films, such that the packaging 102 can desirably employ the tear-resistant film 108. This highly beneficial packaging is unavailable with prior art configurations in that either a weak, highly tearable film (e.g., BOPP) is employed, a separate cutting tool is required to open the packaging, or the film is weakened (e.g. perforations) in the area of the tear strip.

The above-described packaging 102 (including the tear-resistant film 108) is available to contain a wide variety of different articles. In one

embodiment, the article 104 includes a plurality of books 130 and a corrugated pad 132, as depicted in Figures 8A and 8B. The plurality of books 130 are stacked on top of the corrugated pad 132, as is commonly done in the shipping and handling industry. The plurality of books 130 can be differently sized and shaped as shown in Figures 8A and 8B, or can be identical. The pad 132 is preferably a corrugated paper material, and is provided to support the plurality of books 130 during shipment thereof. Alternatively, however, the pad 132 can be formed of different materials, can assume other shapes and sizes, or can be eliminated entirely.

In one preferred embodiment, the packaged good article 100 is assembled by first securing the tearable tape strip 110 to a surface of the film 108. With specific reference to Figure 9A, the film 108 generally defines an interior surface 140 and an exterior surface 142 (with the exterior surface 142 being "exposed" in Figures 8A and 8B). With this orientation in mind, the tearable tape strip 110 is preferably secured to the interior surface 140, such as with an adhesive 144 (shown generally in Figure 9A). The adhesive 144 can assume a wide variety of forms, but is preferably a pressure sensitive adhesive known in the art. Regardless, the tearable tape strip 110 is applied to an area of the film 108 that is otherwise unweakened. That is to say, unlike other heavy-duty packaging applications in which the packaging material in question is perforated or weakened as previously described in the region of the tearable tape strip or tear strip, the film 108 is intact opposite the tearable tape strip 110. With this configuration, the packaging 102 is not susceptible to failures otherwise associated with prior art, weakened packaging materials.

In one preferred embodiment, only a single one of the tearable tape strip 110 is required. As previously described, the internal tear characteristic of the tearable tape strip 110 is sufficient to controllably tear the film 108. Alternatively, and with reference to Figure 9B, a second tearable tape strip 146 can be secured to the film 108 substantially opposite the tearable tape strip 110 (i.e., on the exterior surface 142). Preferably, the tearable tape strips 110, 146 are aligned. Alternatively, however, the tearable tape strips 110, 146 can be offset from one another, as shown in Figure 9B. More particularly, the tearable

tape strips 110, 146 are both internally tearable, and each defines a width. At least a portion of the width of the tearable tape strip 110 overlaps at least a potion of the width of the second tearable tape strip 146. With this orientation, a single band of material (identified as "B" in Figure 9B) can simultaneously be internally torn from both of the tearable tape strips 110, 146. Alternatively, a cover tape, such as 373 Scotch® High Performance Box Sealing Tape (available from 3M), can replace of the second tearable tape strip 146.

Returning to Figures 8A and 8B, following the application of the tearable tape strip 110, nicks 150 are formed through the tearable tape strip 110 and the film 108 to define the tab 128 at a leading end 154 of the tearable tape strip 110. In a preferred embodiment, the nicks 150 are formed via a die-cut, although other cutting techniques are equally applicable. While Figure 8A depicts three of the nicks 150, any other number, either greater or lesser, is equally acceptable. Regardless, the tab 128 is available for grasping by an end-user (not shown) to initiate tearing of the tearable tape strip 110.

The film 108 is then formed to define the enclosed region 106 within which the article 104 is contained. In one preferred embodiment, a shrink-wrap process, as known in the art, is employed. For example, the film 108 is wrapped about the article 104 (including the books 130 and the pad 132) and opposite ends sealed together. The packaged good article 100 is then passed through a heat tunnel (not shown), causing the film 108 to shrink tightly about the article 104. For example, where the film 108 is a polyethylene material, heat shrinking of the film 108 may be done in approximately six seconds at 250° C, such as in a heat shrinking, forced air oven. Alternatively, the heat shrinking process can be carried out at other temperatures and/or times. With the preferred heat shrink technique, the film 108 substantially conforms with a shape of the article 104, and prevents undesirable shifting or movement of the article 104 (e.g., movement of one or more of the books 130 relative to the pad 132) during shipping.

The packaging 102 is opened (i.e., transititioned from the closed state of Figure 8A to the open state of Figure 8B) by simply grasping the tearable tape strip 110 at the tab 128 and pulling outwardly, away from the packaging 102.

This tearing action controllably tears an opening 160 through the film 108. For example, the tab 128 is formed to define an initial point of separation between the central section 120 and the opposing sides 122. As the central section 120 is torn from the opposing sides 122, a portion of the film 108 otherwise secured to the central section 120 tears relative to portions of the film 108 otherwise secured to the opposing sides 122. This preferred "internal tear" characteristic of the tearable tape strip 110 thus provides for a controlled tearing of the film 108, with the opposing sides 122 preventing undesired tear propagation away from the central section 120, and reinforcing the film 108 at the point of tear so that a highly confined tearing force (overcoming a tear strength of the film 108) can be generated via a relatively small pulling force on the tab 128. Further, the internal tear characteristic of the tearable tape strip 110 overcomes the inherent propensity of the film 108 to stretch. That is to say, by securing or bonding the film 108 to each of the central section 120 and the opposing sides 122, a stretch of the film 108 is constrained by the tearable tape strip 110.

Once formed, the opening 160 allows the end-user to access the article 104 contained by the film 108. In this regard, tearing of the tearable tape strip 110 continues until the opening 160 is sufficiently sized to allow removal of at least a portion of the article 104, such as one of the books 130.

As previously described, and in a preferred embodiment, the single, tearable tape strip 110 is secured to the interior surface 140 (Figure 9A) of the film 108. With this orientation, an outward pulling force applied to the tab 128 more easily tears the film 108. Further, and with additional reference to Figure 8A, because only a single one of the tearable tape strip 110 is required with the one preferred embodiment, indicia 162 can be formed on the exterior surface 142 opposite the tearable tape strip 110. The indicia 162 can assume a wide variety of forms (e.g., alphanumeric, images, logos, bar codes, etc.), and is preferably printed onto the exterior surface 142 using known techniques. As shown in Figure 8A, the single, tearable tape strip 110 does not obstruct viewing of the indicia 162. It will be understood, however, that the indicia 162 can be omitted, and therefore is not a required element.

As previously described, the article 104 can assume a wide variety of forms other than the one depicted in Figures 8A and 8B. For example, Figure 10 depicts an alternative embodiment packaged good article 170 including packaging 172 and an article 174. The packaging 172 defines an enclosed region 176 within which the article 174 is contained.

The packaging 172 is highly similar to the packaging 102 (Figure 8A) previously described, and includes a continuous, tear-resistant film 178 and a tearable tape strip 180. The tearable tape strip 180 is preferably secured to an interior surface (hidden in Figure 10) of the film 178, and is configured to controllably tear the film 178 upon tearing of the tearable tape strip 180. As shown in Figure 10, a series of nicks 182 are formed through the tearable tape strip 180 and the film 178 so as to define first and second tabs 184a, 184b. Alternatively, a single one of the tabs 184a, 184b can be formed, and can be positioned at a location other than that shown.

The article 174 includes a plurality of canisters 190 and a tray 192. The plurality of canisters 190 can assume a wide variety of forms, such as beverage cans, and may or may not be identical. The tray 192 is preferably formed of a corrugated paper material and supports the plurality of canisters 190. Alternatively, the tray 192 can assume other forms, and can be eliminated entirely.

As with the packaged good article 100 (Figure 8A) previously described, the film 178 is preferably shrink wrapped about the article 174 such that the film 178 substantially conforms with a shape of the article 174. As part of the shrink-wrapping process, openings 194 (one of which is shown in Figure 10) are typically formed by the film 178 at opposite sides. Thus, the film 178 need not necessarily entirely encompass the article 174. However, with the preferred shrink-wrap technique, the packaging 172 secures the plurality of canisters 190 within the tray 192. Further, by employing a tear-resistant material for the film 178, the packaged good article 170 can withstand the rigors associated with normal shipping and handling.

The packaging 172 is easily openable by an end-user without requiring use of a separate cutting tool. A user simply grabs one or both of the tabs 184a,

184b and pulls outwardly. Once again, the tabs 184a, 184b are configured to initiate an internal tear within the tearable tape strip 180. The tearing action, in turn, controllably tears an opening (not shown) through the film 178, affording access to the article 174, such as one of the plurality of canisters 190. A portion or entirety of the article 174 can then be removed from the packaging 172 of the opening.

Yet another alternative embodiment packaged good article 200 is illustrated in Figure 11. As with previous embodiments, the packaged good article 200 includes packaging 202 and an article 204. The packaging 202 defines an enclosed region 206 within the which the article 204 is contained.

The packaging 202 is similar to that previously described, and includes a continuous, tear-resistant film 208 and a tearable tape strip 210. The tearable tape strip 210 is preferably secured to an interior surface (hidden in Figure 11) of the film 208. Further, a series of nicks 212 are formed through the tearable tape strip 210 and the film 208 to define first and second tabs 214a, 214b. Alternatively, a single one of the tabs 214a, 214b can be formed, and may be located at a position other than that illustrated in Figure 11.

The article 204 includes a chair 220 and a tray 222. The tray 222 is preferably formed from a corrugated paper material and maintains the chair 220.

As with previous embodiments, the film 208 is preferably shrink wrapped about the article 204, such that the film 208 substantially conforms with a shape of the article 204. With this one preferred configuration, the packaging 202 tightly binds the chair 220 to the tray 222, such that the article 204 is more easily handled.

The packaged good article 200 is opened by simply grasping one or both of the tabs 214a, 214b and imparting a pulling force thereon. Once again, this pulling force causes the tearable tape strip 210 to internally tear, in turn tearing an opening (not shown) through the film 208. The tearable tape strip 210 is torn to an extent necessary to effectuate removal of the chair 220 from the packaging 202.

Yet another alternative embodiment packaged good article 230 is shown in Figure 12. As with previous embodiments, the packaged good article 230

includes packaging 232 and an article 234. The packaging 232 defines an enclosed region 236 within which the article 234 is contained.

The packaging 232 includes a continuous, tear-resistant film 238 and a tearable tape strip 240. The tearable tape strip 240 is preferably secured to an interior surface (hidden in Figure 12) of the film 238. Further, a series of nicks 242 are formed through the tearable tape strip 240 and the film 238 to define a tab 244 forming an initial point of internal tearing through the tearable tape strip 240. Alternatively, a plurality of tabs 244 can be provided, and/or located at other positions along the tearable tape strip 240.

In the embodiment of Figure 12, the article 234 includes a mechanical part 250 (shown in simplified, block form) and a pad 252. As is known in the art, the pad 252 supports the part 250 during shipment. Alternatively, a plurality of parts 250 can be provided and/or a different item(s) substituted for the part 250.

The film 238 is preferably skin packaged about the article 234. Skin packaging techniques are known in the art and causes the film 238 to adhere to the pad 252 while generally conforming a shape of the part 250.

The packaging 232 is opened by first grasping the tab 244 and then pulling outwardly. This action generates an internal tear within the tearable tape strip 240, and in turn tearing an opening (not shown) through the film 238.

Tearing of the tearable tape strip 240 on the film 238 continues until the opening (not shown) is sufficiently sized to facilitate removal of the part 250 therethrough. Notably, a conventional, narrow-width tear strip can be employed to tear through the corrugated or paperboard pad 252. However, such a design results in defacement or destruction of the pad 252, and thus of any indicia carried thereon. In contrast, the packaging 232 of the present invention only tears the film 238, leaving the pad 252 intact.

Yet another alternative embodiment packaged good article 260 is illustrated in Figure 13. The packaged good article 260 includes packaging 262 and an article 264. The packaging 262 defines an enclosed region 266 within which the article 264 is contained.

The packaging 262 is similar to previous embodiments, and includes a continuous, tear-resistant film 268 and a tearable tape strip 270. The tearable tape strip 270 is preferably secured to an interior surface (hidden in Figure 13) of the film 268. Further, a series of nicks 272 are formed through the tearable tape strip 270 and the film 268 and define a tab 274. Alternatively, a plurality of tabs 274 can be provided and/or located at positions other than illustrated. Once again, the tab 274 generates an initial point of internal tear within the tearable tape strip 270 and provides a surface for a user to grasp.

The article 264 includes a food product 280. In the one embodiment of Figure 13, the food product 280 is a half ham. Alternatively, a wide variety of other food products are equally acceptable, including other meats (e.g., ground hamburger, poultry, etc.), seafood (e.g., fish, shrimp, etc.), dairy products (e.g., cheese, butter sticks, etc.), baked goods (e.g., cakes, breads, etc.), to name but a few. While the food product 280 depicted in Figure 13 is a unitary item, a plurality of food products, either identical or different, can be provided and/or placed within a supporting tray. Further, although not shown, a lightweight, readily tearable barrier film approved for contact with food, such as cellophane, may be wrapped about the food product 280 (i.e., between the food product 280 and the film 268) to maintain freshness. Alternatively or in addition, a cover tape or tab can be placed exteriorly over the nicks 272 to prevent moisture and/or air from contacting the food product 280.

As with previous embodiments, the film 268 is preferably tightly wrapped about the article 264. The food product 280 can be removed from the packaging 262 by tearing the tearable tape strip 27, and thus the film 268, as previously described.

The packaging and packaged good article of the present invention provides a marked improvement over previous designs. First, a continuous, tear-resistant film is employed to protect and secure the contained article during shipment thereof. The tear-resistant nature of the film minimizes package failure. Further, the tearable tape strip facilitates easy opening of the packaging without requiring use of a separate cutting tool. Thus, the packaging eliminates the inconvenience, safety, and product damage concerns typically encountered

when using a cutting tool to open tear-resistant film packaging. Finally, the packaging provides an end-user with evidence of possible tampering.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes can be made in form and detail without departing from the spirit and scope of the present invention. For example, only a few possible articles useful with the packaging of the present invention have been described. A virtually infinite number of articles including one or a plurality of products that are regular or irregular in shape can be packaged.